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Defining X-Ray Diffraction Parameters for the Design and Operation of a Planetary-Surface Rock Analyzer

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Introduction

We note here some changes from our original planning, as necessitated by external demands on our research direction. The joint research proposed by SJSU in conjunction with NASA Ames was conducted at both Ames and SJSU, with the prime site becoming Ames rather than SJSU as originally proposed. Rendy Keaten (SJSU student) who conducted a large portion of the research effort spent at least one month per year at NASA Ames, and thus the JRI Special Criteria item 3 is satisfied, rather than item 4 which refers to the need for joint publication -- the criterion we had originally planned to satisfy.

Research Objectives

Our joint research effort was aimed at developing techniques for x-ray diffractometry that was being investigated by NASA as possible flight instrumentation for the exploration of Mars. SJSU would provide the use of in-house x-ray facilities for calibration of the instrumentation, and would provide technical expertise regarding interpretation of data acquired during both laboratory testing, and during field testing of instruments on the Marsokhod rover at Ames.

Accomplishments

- Quantification of x-ray signals from rock surfaces using SJSU diffractometer.

- Development of criteria for fingerprinting rock samples using pattern recognition of diffraction spectra, and augmentation of diffraction data with x-ray fluorescence information.

- Calibration of NASA instrumentation using SJSU-generated data.

- Assistance in the development, lab testing, and field deployment of the NASA instrument on the Russian Marsokhod roving vehicle designed for martian exploration

Publications/Presentations

These publications were either generated directly by the research, or they refer to the JRI effort:

1) Marshall, Bratton, Koppel, Seward, & Keaten. X-ray techniques for in situ analysis of the martian surface: Preliminary results from a miniature diffractometer, Trans. Am. Geophys. Union, EOS, F334, 1995.

2) Marshall. A strategy for in situ analysis of the martian surface, LPS XXVII, 809, 1996.

3) Marshall, Bratton, Keaten, Seward, & Koppel. In situ mineral identification for Mars: Results from a miniature x-ray diffractometer deployed on the Marsokhod rover, LPS, XXVII, 815, 1996.

4) Koppel and Marshall. Development of x-ray diffractometer technologies for planetary exploration, 45th Annual Denver X-Ray Conf., in press, 1996.

5) Marshall & Metzger. Interpretation of complex x-ray diffraction patterns acquired during in situ reconnaissance of planetary surfaces, Geol. Soc. of Am., in press, 1996.